

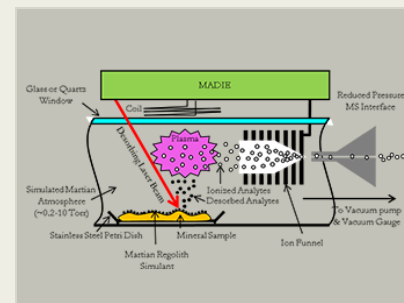
Ambient Desorption, Ionization, and Extraction Source for Mars Exploration, Phase I

Completed Technology Project (2017 - 2018)



Project Introduction

Trace Matters Scientific LLC proposes to design, develop, and prototype a miniature ambient desorption, ionization, and extraction source (MADIE) as a compact all-in-one instrument for operation under the ambient Martian environment to sequentially desorb, ionize, and extract analytes from Martian samples. The MADIE will enable in situ interrogation of the Martian mineralogical samples with no sample preparation and/or separation when coupled to a mass spectrometer. At the core of the proposed MADIE will be a self-tuning plasma ionization module for sample ionization, consisting of an ambient carbon dioxide plasma source and a tuning circuit; an ion funnel module for efficient ion extraction; and a laser diode module for time-resolved sample desorption. The ambient plasma source will utilize the Martian atmosphere, which is mainly composed of carbon dioxide, to form a reduced-pressure carbon dioxide inductively coupled plasma (ICP) to ionize the plume of sampled analytes. The tuning circuit will compensate any plasma variation and maintain the plasma source at resonance during operation. The ion funnel module, which will be derived by a radio frequency power supply, will efficiently extract the ions and guide them into the mass spectrometer to increase sensitivity. The laser diode module will produce a plume of sample analytes from the sample surface with high spatial resolution at both ultraviolet (UV) and infrared (IR) wavelengths. During phase I, the self-tuning plasma ionization module will be designed and constructed, and the ion funnel will be designed and simulated with SIMION and then prototyped. Commercially-available laser modules at various wavelengths will be selected and experimentally validated. These modules will then be pieced together to develop a breadboard prototype of the MADIE by the conclusion of phase I. Preliminary experiments will be conducted to test the efficiency of the MADIE.



Ambient Desorption, Ionization, and Extraction Source for Mars Exploration, Phase I Briefing Chart Image

Table of Contents

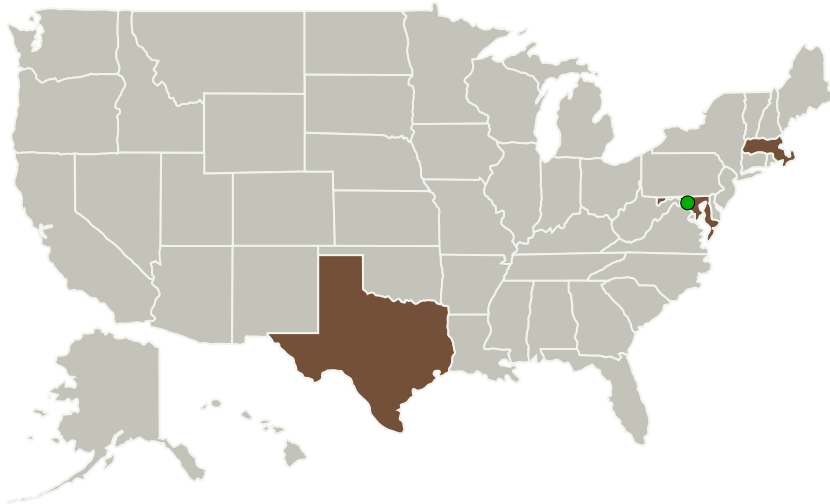
Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Trace Matters Scientific, LLC	Lead Organization	Industry	Houston, Texas
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland
Rice University	Supporting Organization	Academia	Houston, Texas

Primary U.S. Work Locations

Maryland	Massachusetts
Texas	

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Trace Matters Scientific, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

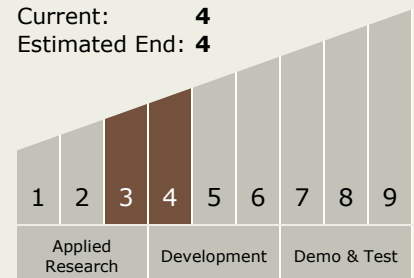
Carlos Torrez

Principal Investigator:

Mazdak Taghioskoui

Technology Maturity (TRL)

Start: 3
Current: 4
Estimated End: 4

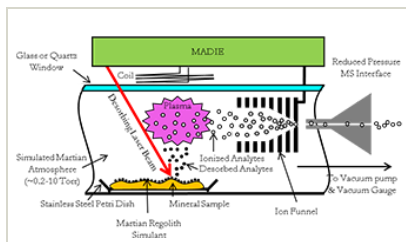


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Images



Briefing Chart Image

Ambient Desorption, Ionization, and Extraction Source for Mars Exploration, Phase I Briefing Chart Image

(<https://techport.nasa.gov/image/134150>)

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.5 Lasers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System